

Quarterly Report

FY - 2008

Quarterly Period Starting 1 January 2008 through 31 March 2008

Second Quarter

Highlights From the Director's Desk

Construction nears finishing stages for the new CAES research facility

Completion of the 55,000 square foot high-performance CAES research facility is scheduled for Aug. 1, 2008; according to Big-D Construction, this target date remains within reach despite the unusually snowy and cold winter.

The CAES facility, which is sited north of University Place in Idaho Falls along the east bank of the Snake River, will provide infrastructure for the CAES public/private partnership that includes Boise State University (BSU), Idaho State University (ISU), the University of Idaho (UI), and the Idaho National Laboratory (INL). Labs and offices will house

CAES programs focused on advanced energy research and education including university faculty and students, national lab researchers, and industry.

The photo below left shows the first floor office area with its raised floor that accommodates a flexible utility and IT infrastructure. The photo below right shows the south

face of the building with the steel structure that supports a permanent sunshield installed and the first exterior siding panels installed. The CAES web site, www.caesenergy.org, features a time-lapsed video of the entire construction project updated every Friday.

CAES Building in Progress



Idaho State Legislature and Governor Otter Approve CAES Funding

On March 5, 2008, the Idaho Joint Finance-Appropriations Committee (JF-AC) voted to set aside \$1.6 million for CAES. The request, which originated with the CAES university partners (BSU,

ISU, UI), was brought to the JF-AC by the Idaho State Board of Education as part of the annual budget for the state universities, and has been approved by Governor Otter. The universities will use these funds to support faculty who are engaged in the CAES research and education mission.

ISU President Advocates for CAES

ISU President Arthur Vailas addressed the Idaho Falls City Club on March 28, 2008 in ISU's Bennion Student Union at University Place in Idaho Falls. In describing his vision for an eastern Idaho energy cor-

ridor, President Vailas cited CAES as evidence of eastern Idaho's unique capabilities directed at developing clean, alternative energy.

ISU and UI Appoint New Vice Presidents for Research

Both ISU and UI recently announced the appointment of

new Vice Presidents for Research (VPR). John (Jack) McIver, Ph.D., an internationally known physicist, comes to UI from the University of New Mexico. Dr. McIver replaces John Tracy, Ph.D. who served a year-long interim appointment as VPR and will return to the directorship of the Idaho Water Resources Research

Institute. Pamela Crowell, Ph.D., currently an associate dean for research and graduate education, comes to ISU from the Indiana University/Purdue University Indianapolis School of Science. Dr. Crowell replaces Larry Ford, Ph.D., who was been the interim VPR. CAES welcomes Drs. McIver and Crowell and thanks Drs. Tra-

cy and Ford for their many contributions to CAES.

Idaho Academy of Science Celebrates 50 Years of Service

The Idaho Academy of Science celebrated its fiftieth year at its annual meeting with a special focus on science and research in Idaho. The Idaho Cancer Research

Association, the Idaho-Utah Section of the American Association of Physics Teachers, and CAES each organized a day-long symposium. A feature story on the CAES symposium, "Energy in Idaho," appears later in this quarterly report.

Path Forward

During the third quarter of FY2008, CAES will:

- Co-host a workshop and short course on high-level nuclear waste with BSU, ISU, the INL and the UI. For additional informa-

tion, see the website <http://www.univeplace.org/hlw/index.html>

- Continue forward progress with the five CAES research initiatives focused on: Carbon and Water

Management, Bioenergy, Nuclear Fuel Cycle, Energy Policy, and the Advanced Test Reactor National Science User Facility.

- Finalize move-in plans with the CAES facility

project teams and begin implementing the Occupancy and Facility Management Plans.

Quarterly Highlights

Infrastructure Management:

While CAES research facility construction remains on schedule, CAES partner institutions continue to build research infrastructure with CAES support. Accomplishments this quarter include:

Boise State University (BSU) has also been moving forward to develop high temperature mechanical testing capabilities with the acquisition of an MTS 810 material testing system, which provides a broad array of testing capabilities for both low and high force static and dynamic testing. This load frame will be used in conjunction with a furnace and DC potential drop system, which are on loan from Massachusetts Institute of Technology (MIT) Professor

Ballinger for the High Temperature Materials for Heat Exchanger Applications project with the University of Nevada at Las Vegas, the University of Illinois, the INL, and MIT. Jatu Burns (BSU M.S. student) is shown below working with one of the furnaces that complements the MTS system.

The high temperature heat exchanger collaboration was formed when the team co-authored a NERI-C proposal in the summer of 2007. Although the proposal was not funded, the team developed alternative funding mechanisms that allow the project to move ahead. Fatigue and

creep crack growth tests will be conducted in air at temperatures ranging from 700 to

1000 °C. Such work supports the Next-Generation Nuclear Plant (NGNP) program.



BSU Students Prevail at TMS 2008:

Dr. Megan Frary and 10 BSU students recently attended The Minerals, Metals & Materials Society (TMS) 2008 Annual Meeting & Exhibition, March 9-13, in New Orleans, LA. The students enjoyed great success at the conference:

1. BSU took second place (almost first!) in the TMS Materials Bowl. The team included Becca Ahern, Pat Andersen, Sharla Hopkins and Alex Miller, all Materials Science and Engineering (MSE) juniors. They won \$1000 for the student club.

2. Doug Kellis (MSE senior) received a \$3000 scholarship from the Materials Processing & Manufactur-

ing Division and also received a \$500 travel grant to attend the meeting.

3. Becca Ahern and Alex Miller (MSE juniors) each received \$500 travel grants to attend the meeting.

4. Student poster contest winners (each receives \$500)

- » Sharla Hopkins (MSE junior) won best undergraduate poster in the Materials Processing & Manufacturing Division

- » Jemima Fernandez (MSE M.S. student) won best graduate poster in the Electronic, Magnetic, & Photonic Materials Division

- » Mariela Bentancur (MSE senior) won best undergraduate poster in the

Electronic, Magnetic, & Photonic Materials Division

- » Mariela Bentancur (MSE senior) won Best of Show poster from among all student poster contest entries (graduate and undergraduate combined).

She receives a \$2500 cash prize.

5. Pat Andersen (MSE junior), Lou Bonfrisco, and Scott Schlegel (both MSE M.S. students) presented their work during the technical sessions.



Professor Megan Frary, front row right, with the BSU student team.

CAES Hosts “Energy in Idaho” Symposium for the Idaho Academy of Science

In support of the Idaho Academy of Science (IAS) Fiftieth Anniversary Meeting, CAES hosted a day long symposium entitled “Energy in Idaho” at the new College of Western Idaho campus in Nampa, ID on March 28, 2008. Presentations were moderated by CAES Deputy Director Kevin Kostelnik (INL) and CAES Associate Directors John Freemuth (BSU) and Robert Smith (UI). The presenters included representatives from Idaho’s private sector and research community.

Topic	Presenter	Affiliation
Introduction to the Center for Advanced Energy Studies	Kevin Kostelnik	Center for Advanced Energy Studies
Next Generation Nuclear Plant	Rafael Soto	Idaho National Laboratory
Biofuel Briquettes	Owen McDougal	Boise State University
Biodiesel	Paul Mann	Blue Sky
Solar Power	Karl Taft	Hoku Scientific
Geothermal Power	Kevin Kitz	US Geothermal
Supplying the Wind Industry	Don Schwemmer	AMET
Energy Investments in Idaho	Woody Preucil	13D Research
Public Discourse Methods in Energy Policy	Eileen DeShazo	Boise State University
Enhanced Separation for Nuclear Fuels	Patricia Paviet-Hartman	Idaho State University
Spark Plasma Sintering of Fuels and Coatings	Megan Frary	Boise State University
Hydrogen	Vivek Utgikar	University of Idaho
Layer Basalt for CO ₂ Sequestration	Sian Mooney	Boise State University
Apomixis – Bioenergy Crops	Jeff Lacey	Idaho National Laboratory
Bioprocessing of Ag. Wastewater	Kevin Ferris	Boise State University

Collaborative Relations:

UI student (shown right) Michael Figueroa, whose mentor is UI professor B. Pesic, is depositing a thick film of metal for subsequent sintering under sparse plasma conditions. The spark plasma sintering (SPS) machine, acquired by CAES and currently operational in the INL/IRC lab, will be relocated to the new CAES facility

this fall. The objectives of Mike's research are to (1) deposit materials precursors by electrochemical methods, (2) to convert the precursors to permanent structure materials by SPS, and (3) to study the microstructure of the final product. Mike performs all electrochemical and structural studies at the UI-Moscow campus and the spark plasma sintering in the INL/IRC labs.



CAES and the Idaho Office of Energy Resources tour Idaho Bioenergy operations

Representatives from the Idaho Office of Energy Resources (OER) and the Center for Advanced Energy Studies (CAES) along with faculty and students from the University of Idaho (UI) toured several industrial bio-energy operations March 19-20, 2008. The tour was lead by John Crockett, Senior Energy Specialist for OER. Participants included Lisa LaBolle (OER), Robert Smith (UI, CAES Assoc. Dir.), Judi Steciak (UI), Josh Gibson (UI graduate student), Katie Leichliter (UI graduate student), Kevin Kostelnik (CAES Deputy Dir., INL), and Ralph Bennett (INL).

Scott MacKenzie, Vice President of Business Development, ED&F Man, provided a tour of their ethanol production plant in Caldwell, ID. This facility, constructed in 1985, was formerly owned and operated by the J.R. Simplot Company. The feedstock has historically been potato waste but this past December was retrofitted to accept corn. The plant, licensed to produce

6 million gallons per year, has been producing approximately 3 million gallons per year.

Rob Black, co-owner, Blue Sky Biodiesel LLC, provided

a tour of his processing facility in New Plymouth, ID. This is an efficient facility equipped with multi-feed-stock processing capabilities. Biodiesel is a replace-

ment fuel for petroleum diesel which is produced by chemically modifying oils from soybeans, canola and rapeseed, as well as free fatty acids. The plant has been operating since July 2006 and has the capacity to produce 10 million gallons per year.

Doug Pettinger, Director, Environmental, Health and Safety, Glanbia Foods, Inc. provided a tour of the Glanbia facility near Gooding, ID. This cheese processing facility currently produces up to 500,000 ft³ of biogas (~350,000 ft³ ave.) from its anaerobic digester. About 200,000 ft³ of the biogas is now used for heat while the remaining portion is flared. Glanbia is in the process of recovering all of this biogas for their existing operations.

Educational Programs:

Ira Bunch, a BSU M.S. student in Energy Policy, focuses on State of Idaho Energy Policy. Ira is supported as a graduate assistant to the CAES Energy Policy Institute (EPI) and is developing content for the EPI website and developing a press kit and outreach material for an EPI LDRD project investigating methods of public discourse



CAES OER team tours ED&F Man ethanol production plant in Caldwell, ID

regarding nuclear energy. Also supporting this project is BSU student Eileen DeShazo, who in addition studies renewable energy.

On March 5, 2008, five graduate nuclear engineering students were awarded \$1000 scholarships from the University of Idaho – Idaho Chapter of the American Nuclear Society Endowment. They are:

Ph.D. student Vaibhav Sinha, mentored by Dr. A. Tokuhito

M.S. student Michael Figueroa, mentored by Dr. B. Pesic

M.S. Student Robert Hoover, mentored by Dr. S. Phongikaroon

Ph.D. student Artit Ridluan, mentored by Dr. A. Tokuhito

Ph.D. student Piyush Sabharwall, mentored by Dr. F. Gunnerson

Matt Luke, a BSU M.S. student in Materials Science and Engineering, is working on a CAES LDRD project with collaborators at Boise State (M. Frary, D. Butt, J. Perkins), INL (W. Windes), U of Idaho (B. Pesic, M. Figueroa), and Idaho State (T. Hartman, E. Wolfrom). Matt joined the BSU graduate program after earning his B.S. in Materials Science and Engineering in December 2007. Matt will be investigating microstructural development and evolution in spark plasma sintered materials.

Jatu Burns, a BSU M.S. student in Materials Science and Engineering, joined Dr. Megan Frary's research group in January 2008. Jatu will be working on a collaborative project to investigate the high

temperature mechanical behavior of nickel-based super alloys for heat exchanger applications. The team members include M. Frary and D. Butt (BSU), R. Ballinger (MIT), R. Wright (INL), A. Roy (UNLV) and J. Stubbins (U. Illinois).

The BSU Department of Materials Science and Engineering continued to support Patrick Callahan and Lou Bonfrisco this past quarter in their M.S. research.

With INL support, the BSU Department of Materials Science and Engineering project on the oxidation kinetics and processing of nitride fuels continues to support the undergraduate research of Brandon Christopherson who has been conducting research, is writing a paper for publication, and will graduate with his B.S. next quarter. Also supported are undergraduates Gordon Balfour, David Thompsen and Daniel Osterberg. Gordon graduated in December. Daniel will be transferring to the 2+2 nuclear engineering program this fall and will be carrying out an internship this summer at INL. David will graduate with his B.S. in May and plans to pursue his M.S. at BSU.

BSU Department of Materials Science and Engineering students Patrick Callahan and Prakash Periasamy both completed their M.S. theses this quarter. Brian Jaques will be defending his M.S. thesis next quarter on "Synthesis of Actinide Nitrides".

UI reports the following students are currently supported through CAES:

M.S. students Lucas Fowler and Michael Figueroa, mentored by

B. Pesic; U.G. student Charlotte McMurtrey, mentored by V. Utgikar; M.S. students Triratna Shrestha and Robert Hoover, mentored by S. Phongikaroon; Ph.D. students Artit Ridluan and Vaibhav Sinha, mentored by A. Tokuhito; M.S. student Sean McCormick and Ph.D. student Mahmud Faheem, mentored by I. Charit.

Policy Programs:

EPI developed an organizational structure for the Governor of Idaho's 25x'25 Renewable Energy Council which it presented to Paul Kjellander, Director of the Idaho Office of Energy Resources, which was accepted and will be used by the Council. Director Kjellander, who also heads up the Governor's Council, has approved and implemented the EPI structure.

Michael Louis, EPI Assistant Director, serves on the 25x'25 Renewable Energy Council and is assigned to the Energy Plan Directives sub-committee tasked with developing paths for promoting policies recommended by the Council.

David Solan has accepted an offer from the BSU Department of Public Policy and Administration as Assistant Professor of Public Policy. He will focus on energy policy teaching and research.

Program Development:

Dr. Megan Frary's research group (BSU) has also been involved with additional CAES-related research activities at Boise State University including work on spark plasma sintering (SPS) and materials for high temperature heat exchanger

applications. The SPS project is funded by a CAES-related LDRD and involves researchers from BSU, UI, ISU and INL (9 people in total). The initial goal of the project is to understand how SPS processing parameters affect microstructure. Two baseline systems, Ni and W, are being investigated first. Two different specimens have been delivered from INL to BSU where their microstructure and hardness is being characterized. Preliminary results indicate that the Ni specimens have more than 98% theoretical density and uniform hardness. Electron backscatter diffraction will be used to characterize the crystallographic texture of the samples. In the coming months, the team will carry out a more thorough study of processing conditions and their effects on microstructure in both Ni and W. Fatigue and creep crack growth tests will be conducted in air at temperatures ranging from 700 to 1000 °C.

Dr. Butt submitted a proposal to the National Science Foundation, Materials World Network program entitled "Cermet Encapsulation at Very High Temperatures Using Field Assisted Sintering". This proposal is a collaboration between BSU, CAES, INL (Steve Howe), and the Space Research Centre, Department of Physics and Astronomy, at the University of Leicester. In addition, in collaboration with CAES (Ray Grosshans) and Utah State University, Dr. Butt successfully submitted a letter of intent to NSF to create a Center for Advanced Radioactive Material Processing through the I/UCRC program.

UI reports the following proposal activity:

1. “Nuclear Criticality Safety: A Graduate Certificate Program”, by Gunnerson (UI), Tokuhiko (UI), Ostrom (UI) and McBurney-Rebol (UI), to US Nuclear Regulatory Commission, Nuclear Education Grant Program, for \$150,000 K (pending).
2. “Enhancing Education and Research in Hydrogen and Fuel Cell Technologies at the University of Idaho/Idaho State University”, by V. Utgikar (UI), with ISU and the INL, to the DOE Hydrogen Education Development Program (pending)
3. “Development of a Kinetics Model for Electrolytic Reduction of Oxide Fuel,” by S. Herrmann (INL) and S. Phongikaroon (UI), to INL/DOE Pyroprocessing Technology Department, for \$60.4 K (funded)
4. “Development of a Computational Model for Pyrochemical Electrorefiners of Nuclear Waste Transmutation System,” by S. Phongikaroon (UI) with Tae-Sic Yoo (INL) and M. Simpson (INL), to INL/DOE Pyroprocessing Technology Department through INERI program with KAERI and SNU, for \$303 K (funded).
5. “Kinetics Study for Ion Exchange,” by S.

Phongikaroon with K. Bateman (INL) and M. Simpson (INL), to INL/DOE Pyroprocessing Technology Department, for \$75.1 K (funded).

6. “Development Grant for New Faculty”, by F. Gunnerson (UI), to US Nuclear Regulatory Commission, for \$394 K (pending).
7. “NE Graduate Student Support”, by J. Crepeau (UI), to US Nuclear Regulatory Commission, for \$400 K (pending).

Scientific Eminence

Publications:

I. Charit, 2008. “Infusion of Nanotechnology in Nuclear Technology,” Materials Technology, March 2008.

I. Charit, 2008. “Static Strain Aging and Dislocation-Impurity Interactions in Irradiated Mild Steel,” The Journal of Nuclear Materials (in press).

Professional Contributions:

Indrajit Charit (UI), participated in the Nuclear Materials Committee on “Particle Beam-Induced Radiation Effects in Materials” and chaired a conference session at The Minerals, Metals & Materials Society (TMS) 2008 Annual Meeting & Exhibition, March 9-13, in New Orleans, LA

S. Phongikaroon (UI), presented “Development of a Kinetics Model for Electrolytic Oxide Reduction, Phase I: Progress of Model-

ing Development and Plan,” to the Korea Atomic Energy Research Institute.

S. Phongikaroon (UI), presented “Analysis of the Mk-IV Electrorefiner: Phase I-Progress Design,” at the Seoul National University (Korea).

Eileen DeShazo, 2008. Investigation of Public Discourse Methods in Energy Policy Decision-Making, Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Patricia Paviet-Hartmann, Joshua Pak, Eric Brown, Jared Horkley, Earle Wolfrom, 2008. Extraction of Perrhenate and Pertechne-tate by Crown Ethers, Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Megan Frary, Darryl Butt, Matthew Luke, Thomas Hartmann, Earl Wolfrom, Batric Pesic, Michael Figueroa and William Windes, 2008. Microstructural Evolution during Spark Plasma Sintering, Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Vivek Utgikar, Richard T. Jacobsen, Jacob Leachman, 2008. The Future of Hydrogen in Idaho—An Overview, Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Sian Mooney, Travis McLing, Robert Podgorney, Bill Clement, Sian Mooney, Scott Hughes, Jerry Fairley, 2008. Suitability of Layered Basalt as Targets for Industrial Car-

bon Dioxide Sequestration, Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Jeffrey A. Lacey, Thomas H. Ulrich, Robert Zemetra, Alexander Karasev, Alan Poplawski, John Carman, 2008. Discovery of genes responsible for Apomixis in Sorghum Bicolor using Virus-Induced Gene Silencing (VIGS), Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Kevin Feris, Joni Barnes, Cathy Rae, Patrick Sorenson, and Araya Kiepert, 2008. Novel Photoheterotrophs and Biological H₂ Production from Potato Wastewater, Idaho Academy of Science Annual Meeting, Nampa, ID, March 28, 2008.

Recognitions, Awards, Officers in Professional Societies, others.

The Idaho Falls Magazine, March-April 2008, recognized UI Associate Professors of Chemical Engineering Vivek Utgikar and “Supy” Phongikaroon.

The UI Idaho Magazine, Winter 2008, published a cover story entitled “The New Nuclear Reaction” describing the recent growth of the UI nuclear program in the context of the so-called “Nuclear Renaissance.” Featured are Piyush Sabharwall, a UI NE doctoral student, and UI professor Fred Gunnerson.